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National Aeronautics and
Space Administration

NASA Research Announcement

**Research Opportunities
in
Space Biological Sciences**

**Advanced Human Support
Technology Program
2002**

**NRA 02-OBPR-01
March 18, 2002**

**NASA Research Announcement Soliciting Research Proposals for
the Period Ending June 18, 2002**

**Office of Biological and Physical Research
National Aeronautics and Space Administration
Washington DC 20546-0001**

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**Research Opportunities in Space Biological Sciences
Advanced Human Support Technology Program 2002
NRA 02-OBPR-01**

Summary and Supplemental Information

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) is restricted to the Advanced Environmental Monitoring and Control (AEMC) and Advanced Life Support (ALS) Projects within the Advanced Human Support Technology (AHST) Program and the Advanced Extravehicular Activity (AEVA) Project. Investigators should read carefully the individual project descriptions in Appendix A and focus their proposals on the specific research emphases defined in this Announcement. Proposals for Research and Technology Development (R&TD) in areas outside those defined in this Announcement will be returned to the proposer without review. Note that the Space Human Factors Engineering Project within the AHST Program is not soliciting research through this Announcement. The Space Human Factors Engineering Project will solicit research and technology development through the NRA for the Biomedical Research and Countermeasures Program. Information on the release of this and other NASA NRAs can be found on the following Web site:

<http://research.hq.nasa.gov/>

*Proposals received outside of the annual NRA cycle are considered to be **unsolicited proposals**. Programmatically relevant unsolicited proposals in most cases will be held until the next annual review period or will be returned to the proposer without review. However, in all cases, NASA reserves the right to act in the best interests of the Federal Government in the matter of acceptance for evaluation of unsolicited proposals received outside the annual NRA cycle.*

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits proposals to participate in research opportunities in the Advanced Human Support Technology (AHST) Program of the Bioastronautics Research (BR) Division of NASA's Biological and Physical Research (BPR) Enterprise. This Announcement solicits research proposals that support the opening of the space frontier by exploring, using, and enabling the development of space, and by expanding human experience in space. The research supported by the BR Division will increase knowledge of nature's processes using the space environment, aid in the exploration of the Solar System, support the achievement of routine space travel, and enrich life on Earth through the use of space technology and the application of biomedical knowledge. The BPR Enterprise also seeks to share new knowledge, technologies, and assets that promise to enhance the quality of life on Earth.

The mission of the BPR Enterprise is to use the synergy among physical, chemical, and biological research in space to acquire fundamental knowledge and generate applications for space travel and for Earth. The Enterprise will use interdisciplinary fundamental and applied research to find new ways to withstand the space environment, to take advantage of the unique

space environment for conducting research in science and engineering, and to generate new technology.

Research in the AHST Program is in consonance with the following goals of NASA's BPR Enterprise:

- Conduct research to enable safe and productive human habitation of space
- Use the space environment as a laboratory to test the fundamental principles of physics, chemistry and biology
- Use space research opportunities to improve academic achievement and the quality of life

The BPR Division programs represent an opportunity for NASA to enhance and broaden public knowledge, understanding, and appreciation of biological and biomedical research, and the value of this research in the space environment. Individuals participating in NASA's BR Division programs have a responsibility to foster the development of a scientifically informed public. Therefore, all participants in this NRA are strongly encouraged to promote general scientific literacy and public understanding of life sciences, the space environment, and the Space Biological Sciences programs through formal and informal education opportunities. Where appropriate, supported investigators will be required to produce, in collaboration with NASA, a plan for communicating their work to the public (see Appendix A, Section VI for details).

The AHST Program seeks to fund the development of advanced technologies for use on the International Space Station (ISS) beyond the currently baselined technologies, or on a long duration human exploration mission. Special emphasis is placed on those technologies that will have a dramatic impact on the reduction of required mass, power, volume, crew time, and on increased safety and reliability. In addition, technologies proposed for use by NASA that are also applicable to the detection of and response to chemical toxins and pathogenic microorganisms that could potentially be used in counter-terrorism efforts are specifically encouraged.

Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA's safety priority is to protect: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including employees working under NASA instruments), and (4) high-value equipment and property.

For Fiscal Year 2003, each of the three areas of this NRA has a unique proposal solicitation with particular needs for specific kinds of proposals in specific areas of emphasis. Therefore, it is critical that potential applicants read carefully the AHST Program and Project descriptions in Appendix A of this Announcement.

Proposals will be evaluated by independent peer review panels for overall scientific or technical merit, including an assessment of the innovativeness of the proposed work. Where appropriate, NASA will also conduct separately an assessment of the cost, relevance to AHST programmatic needs and goals, flight feasibility, and the feasibility of implementation by NASA after the work

is completed. See Appendix A, Section V for more details on proposal evaluation and awards selection process.

A selection announcement will be made no earlier than November 2002, pending budget availability. Funding of selected proposals will begin at the earliest in December 2002. NASA's obligation to make awards is contingent upon the receipt of proposals that the government determines are acceptable for award under this NRA.

Funds are not currently available for awards under this NRA. The Government's obligation to make award(s) is contingent upon the availability of appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this NRA.

Continuation of multiple year awards is dependent on evidence of satisfactory annual progress (see Appendix A, Sections VII.A and VII.D) and availability of funding.

It is anticipated that there will be 15-20 total awards for proposals submitted in response to this NRA and that awards will average approximately \$175,000 per year. Support for Pilot Studies will be somewhat lower, approximately \$80,000 per study.

Due to programmatic needs and funding constraints, NASA may in certain cases elect to fund only a portion of a proposed effort and/or may request that the applicant collaborate with other investigators in a joint investigation. In these cases, the applicant will be given the opportunity to accept or decline such partial acceptance or teaming with other investigators prior to a NASA selection. Where collaboration with other investigators as a team is agreed to, one of the team members will be designated by NASA as its leader or contact point.

Participation in this Announcement is open to all individuals and all categories of organizations: industry, educational institutions, other nonprofit organizations, NASA laboratories, and other government agencies. Proposals that will enhance or complement the scientific return from research currently being supported by industry or by other government agencies are encouraged. Although NASA, under certain circumstances, will review proposals from non-U.S. institutions, NASA does not fund research at non-U.S. institutions (see Appendix A, Section VII.C).

Awards made as a result of this NRA will primarily be funded as grants. Either a grant, cooperative agreement, or contract may be used; however, to accomplish an effort funded in response to this NRA, NASA will determine the appropriate instrument. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1D). Commercial organizations are encouraged to propose resource sharing in their cost plans.

Further details concerning the AHST Program and the preparation of proposals in response to this Announcement are included in the attached appendices.

- Appendix A provides technical description of AHST Program Projects and other information that is applicable only to this Announcement.

- Appendix B contains application procedures that apply specifically to this NRA.
- Appendix C contains general instructions applicable to the preparation of proposals in response to NASA Research Announcements.

A notice of intent (NOI) to propose is requested by April 18, 2002 (see Instructions, Appendix B of this Announcement). Notices of intent should be submitted via the World Wide Web (WWW) at:

<http://proposals.hq.nasa.gov/proposal.cfm>

If you do not have access to the WWW, you may submit a notice of intent via e-mail to

noi@hq.nasa.gov

The subject heading of the e-mail message should read “NOI NRA 02-OBPR-01.” If you do not have access to e-mail, you may submit an NOI by U.S. Postal Service or commercial delivery to the address listed below for proposal submission.

Proposals may not be submitted electronically. ***Proposals must be received by June 18, 2002, 4:30 PM Eastern Time.*** Proposals and notices of intent mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

NASA c/o NASA Peer Review Services (NPRS)
SUBJECT: 02-OBPR-01 AHST Research Proposal
500 E Street SW
Suite 200
Washington, DC 20024

Proposals and NOIs that are hand delivered or sent by commercial delivery or courier services are to be delivered to the above address between 8:00 AM and 4:30 PM EDT. The telephone number, 202-479-9030, may be used when required for reference by delivery services. NPRS cannot receive deliveries on Saturdays, Sundays, or federal holidays. Upon receiving a proposal, NPRS will send a notification to the proposer confirming its arrival.

In order to be accepted as a complete submission, proposals **must include** the information detailed in Appendix B. Special instructions apply to proposals by institutions that are not entities of the United States (see Appendix A, Section VII.C).

The following items apply only to this Announcement:

Solicitation Announcement Identifier:	NRA 02-OBPR-01
Number of Proposal Copies Required:	Original + 20 copies, double-sided pages
Notice of Intent Due:	April 18, 2002
Proposals Due:	June 18, 2002
Selecting Official:	Director Bioastronautics Research Division Biological and Physical Research Enterprise

Technical Information Point of Contact:

Charles J. Barnes, Ph.D., Acting Lead
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The contracting point of contact will be specified in each selection notification letter.

Your interest and cooperation in participating in this effort are appreciated.

Kathie L. Olsen, Ph.D.
Acting Associate Administrator for
Office of Biological and Physical Research

Technical Description Advanced Human Support Technology

I. Introduction

The National Aeronautics and Space Administration (NASA) Bioastronautics Research (BR) Division seeks proposals for the Advanced Human Support Technology (AHST) Program in support of the Biological and Physical Research (BPR) Enterprise. This Announcement solicits scientific and technical proposals to be funded during fiscal year 2003, either for new research or for the continuation of research beyond the term specified in a previously funded proposal.

This announcement solicits proposals for the following projects within the AHST Program and for the Advanced Extravehicular Activity project. These projects are:

- Advanced Environmental Monitoring and Control (AEMC)
- Advanced Life Support (ALS)
- Advanced Extravehicular Activity (AEVA)

Note: It is critical that the prospective investigator read the relevant project description section(s) in this Appendix carefully, as many of the areas of programmatic emphases are different from those in previous Bioastronautics Research Division NASA Research Announcements (NRAs).

In addition to requirements specified in other sections of this NRA, investigators responding to this announcement for the AHST Program will be expected to do the following:

- Include a one-page justification on how the proposed research satisfies the unique requirements of the AHST program in general and the research element in particular. The justification should include reference to relevant risks identified in the Critical Path Research Plan that the proposed research might mitigate. The Critical Path Research Plan is available at:

<http://criticalpath.jsc.nasa.gov/>
(follow links to appropriate discipline area).

In fulfilling this requirement, investigators are encouraged to refer also to current Project Plans and other relevant background documents. These documents are available at

http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html
(see Bibliography, Section VIII, of this Appendix).

- Establish contact with appropriate NASA field center personnel to determine how the proposed research or technology development activity might fit into NASA's AHST Program.
- Discuss (and quantify, if possible) in their proposal the potential benefit of their work to NASA in terms of minimization of mass, power and crew time utilized, increased system reliability, safety, or other factors for present or future missions. Investigators are encouraged to refer to the system analysis assumptions as reflected in the ALS baseline values and assumption document (BVAD) and the discussion of equivalent system mass (ESM) in the ALS Metric. These documents may be found at the following Web site:

http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

- Assure compliance with federal regulations regarding human subjects and/or animal care as part of the proposal submission process (see the "Special Matters" section in Appendix B). NASA has a strong commitment to the ethical treatment of human and animal research subjects. Applicants should note that review of proposals involving human or animal research subjects will not be undertaken if the required information is not supplied.

II. Types of Proposals Sought

Each of the project areas described in this announcement has unique needs for specific kinds of proposals in specific areas of emphasis. *Proposals for Research and Technology Development (R&TD) in areas outside the specific areas of emphasis listed in this Announcement will likely receive lower priority for funding.*

A proposal may be multidisciplinary or interdisciplinary, involving combinations of these research and technology development project areas. For such proposals, the teaming arrangements should be clearly stated. Flight proposals should include a well-defined development plan that can be accomplished within **three** (or fewer) years.

In addition to the overview information listed below, prospective investigators should also read carefully the individual project descriptions in Section III of this Appendix. Investigators also should be aware of the concept of Technology Readiness Levels (TRL) as it applies to their work (see Figure 1). *Research and technology development funded through this NRA will be at lower TRL levels only.*

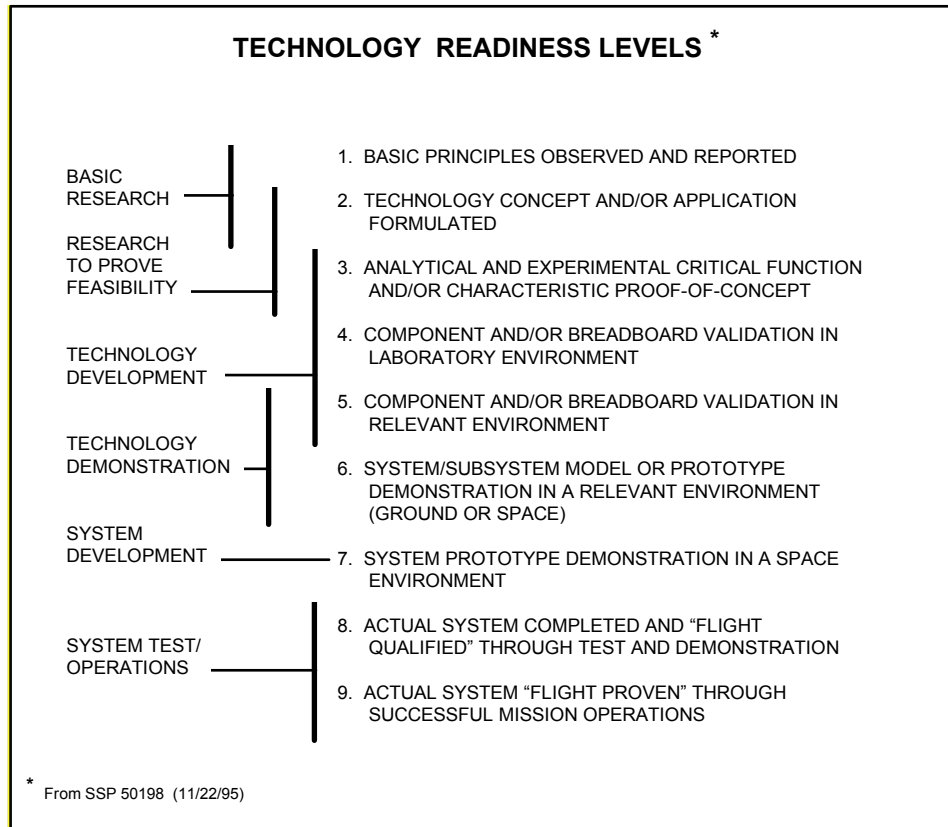


Figure 1. NASA Technology Readiness Levels

The AHST Program solicits the following kinds of proposals for FY 2003:

1. Ground-Based Research and Technology Development (open to all project areas for FY 2003)

These are proposals to carry out a research study or technology development in a ground-based laboratory. Typically these will be for low TRL work (TRL 1-3, see Figure 1) with a clearly defined set of technical objectives relevant to NASA's BPR Enterprise goals. Awards in this category are for no more than three years.

2. Ground-Based, Pilot Studies (open to all project areas for FY 2003)

High-innovation, high-risk technology development Pilot Study proposals for low TRL work (TRL 1-2, see Figure 1) are solicited. Pilot Studies are expected to propose highly innovative approaches or to explore new research paradigms or concepts that will strongly affect human support technologies, even if they are highly speculative or contain a substantial risk of failure. The goal of this type of proposal solicitation is the rapid insertion of highly innovative new research ideas into demonstration technologies [e.g., for the International Space Station (ISS) or for an integrated ground test facility]. Awards in this category are for no more than 18 months and require attendance at two

NASA-lead Principal Investigator (PI) team meetings during the course of funding. PIs given a Pilot Study award will be expected to form and participate in teams that develop follow-on proposals for longer-term work leading to direct insertion into a NASA AHST application.

To facilitate the overall goal of rapid insertion, the review of Pilot Studies will emphasize specific review criteria. Pilot Studies will also have unique follow-on requirements. Review criteria and follow-on requirements are detailed in Section V.B of this Appendix.

For the Pilot Study proposal category, the initial 18 months of Phase I funding is envisioned to be the first of two possible phases. Phase II funding is not guaranteed by Phase I funding; however, Phase I funding is a prerequisite. Phase II will emphasize the integration of Phase I approaches into actual technology development, with a strong emphasis on teaming. Teams will be developed among PIs and between PIs and NASA researchers. Team development for Phase II will be facilitated through the NASA Headquarters (HQ) lead and the NASA Technical Monitor for the Phase I projects. Teams developed for Phase II projects will be expected to propose within three months of completion of Phase I. Phase II proposals will be separately evaluated, but will use criteria as described in Section V.C. of this Appendix, with an emphasis placed on probability of successful development of a prototype instrument that can be demonstrated in a relevant environment at the end of the three-year funding period.

Currently funded AHST PIs may contact relevant NASA personnel if interested in participating in future teaming and proposal development.

3. Space Flight Experiments (open to all project areas for FY 2003)

Proposals are sought to carry out scientific and technical studies on the International Space Station (ISS) that can be implemented with the limited resources available during the late assembly phase. Space studies proposed for the ISS are severely constrained by limitations on resources, such as weight, power, and crew time, and by the availability of flight hardware. Proposals requiring resources beyond the capabilities defined in this Announcement should **not** be submitted at this time. Flight investigations must represent mature studies strongly anchored in previous ground-based research and/or previous flight research and must be thoroughly justified.

III. Areas of Research and Technology Emphasis for FY 2003

A. Advanced Environmental Monitoring and Control (AEMC)

Project Description

The AEMC Project of the AHST Program develops advanced technologies to monitor the physical, chemical, and microbial environments of both the human compartments and life support systems of current and future spacecraft and extravehicular activity (EVA) systems. The

AEMC project provides technology for reducing crew and equipment risk that is comparable to or better than currently available technology. Advancements in microelectronics and biotechnology are expected to provide the backbone for these technologies in future missions. The AEMC Project also develops advanced control systems to maintain internal environments in the states necessary for crew health and safety. The control system may also take advantage of microtechnologies that are capable of effector functions, for example, capture and removal of bioparticles.

Proposals Sought for FY 2003

Proposals are sought across all areas of sensor technology and control concepts and implementation that will have a dramatic impact on the reduction of required mass, power, volume, crew time, and increased safety and reliability. The impact may be direct, for example, through drastic reduction of the size of a monitoring technology; or the impact may be indirect, if, for example, improved monitoring leads to the elimination of the need for a processing step.

The response time of the monitoring or control technology should be appropriate for the intended application. For example, an event such as a fire must be detected and responded to swiftly; whereas a gradual buildup of trace chemicals over several months could be monitored on an infrequent basis. The environments of interest include air, water, surfaces, food supplies, and all life support processing technologies. EVA sensors of interest include small low power/mass technologies for monitoring spacesuit internal/external environment and biomedical parameters.

Proposals may cover the development of new technologies, the refinement and micro-miniaturization of currently available sensors, new control paradigms that clearly demonstrate reduced risk, or very high-risk, very high-payoff new concepts that may lead to advanced sensors or control concepts with vastly improved capabilities. Technologies that may meet these needs with multi-use capability are desirable. Sensors that can monitor multiple media (e.g., air and water) have the potential to reduce mass and volume in terms of redundant units (i.e., one unit may serve as a backup for two systems). Environmental monitoring technologies may be useful for noninvasive physiological measurements, as well as for habitat use.

Finally, because of NASA's strong commitment to public safety, as well as our mission to create a safe environment for astronauts, proposals for sensor technologies and control systems that also focus on advanced technologies for terrestrial applications such as counter-terrorism are highly encouraged.

Both conventional (Section II.1) and pilot study (Section II.2) proposals are sought.

For FY 2003, the AEMC Project will emphasize

Monitoring the Microbial Environment

Maintaining a safe microbial environment is important for astronaut health, as it is also for public safety. It is important to ensure a safe, appropriate microbial environment in the air, water, food, and on surfaces, as well as in the different life support subsystems. Proposals are sought that will take advantage of the latest in biotechnology research to provide easy-to-use, rapid, sensitive, accurate assessment of the microbial environment while employing little or no expendables, and requiring minimal sample preparation.

Water Quality Monitoring

Future space missions will routinely recycle water. It is therefore important to monitor for the gradual buildup of, or accidental contamination with, harmful chemicals, both organic and inorganic. As the toxicity varies from species to species, identification and quantification of individual species is desirable.

Advanced Control Systems Approaches

A system to support life in space is both highly complex and critical to safety. It is therefore essential to have an efficient communication network and an intelligent control system capable of autonomous assessment of monitoring and control system status and having ability to respond, as necessary, to changes in system status. This NRA will emphasize

- Advanced approaches for efficient, reliable, optimal control, which can be incorporated in a straightforward manner. Advanced tools for modeling system behavior and incorporating these models into a control strategy
- Advanced approaches for integrating the control strategies among the interacting subsystems, which are expected to include air revitalization, water reclamation, biomass production, food processing, and waste management.
- Tools for global assessment of control design strategies and monitoring applications

Approaches should include strategies for recovery from perturbations. Perturbing upsets may be physical, chemical, or biological in nature that may eventually lead to the subsystem/system failure.

Proposals outside the above areas of emphasis will be accepted but may be given somewhat lower priority, at the discretion of NASA.

AEMC Flight Experiments (see also Flight Experiments, Section IV of this Appendix)

Microgravity effects can play a strong role for AEMC technologies in the space environment. Sensors that monitor or use liquids such as water generally face microgravity effects. Analysis of head space (the air space above a liquid sample) constituents, a common technique in ground-

based laboratories, is problematic in microgravity.

Flight experiments should have as their objective the test or validation of monitoring and control technologies in the space environment. Of interest is the monitoring and control of environmental parameters, including air/water major constituents and trace contaminants, as well as the microbial environment in air, in water, and on surfaces. Initial activities should focus on the evaluation of advanced environmental sensors and controls that will help to ensure crew health and safety while moving well beyond ISS baseline in terms of lower volume, minimal mass and power consumption, with increased sensitivity and less reaction time.

NASA Technical Contacts

In order for applicants to better understand NASA's scientific and technological needs, and to enable more effective transfer of their scientific and technological advances to NASA, it would be advantageous for applicants to explore opportunities to interact with the NASA AEMC contact personnel listed below:

Charles J. Barnes, Ph.D.
Code UB/Bioastronautics Division
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001
Telephone: 202-358-2365
E-mail: cbarnes@hq.nasa.gov

Darrell L. Jan, Ph.D.
Jet Propulsion Laboratory
MS 125-224
4800 Oak Grove Drive
Pasadena, CA 91109-8099
Telephone: 818-354-4542
E-mail: djan@jpl.nasa.gov

Supporting Documents

- Advanced Environmental Monitoring and Control Project Plan (1999)
- Advanced Environmental Monitoring and Control Technology Development Requirements (1998)
- Advanced Environmental Monitoring and Control Strategic Plan (1996)
- Advanced Environmental Monitoring and Control Program: Technical Assessment Matrix
- Advanced Environmental Monitoring and Control Roadmap (1999)
- Advanced EVA Systems Roadmaps (JSC 2000)
<http://www.jsc.nasa.gov/xa/advanced.html>
- Advanced EVA Exploration Requirements (JSC 2000)
<http://www.jsc.nasa.gov/xa/advanced.html>

Unless otherwise noted, these supporting documents can be accessed via the Internet at the following address:

http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

Related Areas

Research proposals to establish environmental standards for human health will be solicited through the Environmental Health Project as part of the upcoming Biomedical Research and Countermeasures Program NRA.

B. Advanced Life Support (ALS)

Project Description

The ALS Project of the AHST Program develops technologies for advanced regenerative life support systems to support human missions in space. Such missions, including the ISS and possible future planetary exploration, may last from months to years. Resupply of life support materials is expensive and, in some cases, may be extremely difficult, necessitating greater self-sufficiency of the subsystems used on the mission. Integrated ground test facilities, under development by the ALS Project, will be used for demonstrating, validating, and integrating physicochemical and biological subsystems that fully recycle air and water, recover resources from solid wastes, provide thermal control, and provide and process food (fresh and pre-packaged) for the crew.

Proposals Sought for FY 2003

In all areas, proposals are sought that will dramatically advance the goals of optimization of mass, power, volume, crew time, reliability, and autonomy for an ALS subsystem. The equivalent system mass (ESM) of the life support system serves as a good aggregate measure (see ALS Metric on the WWW at http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html) of life support system performance and is critical in determining the cost of human space flight. Therefore, proposals that take into consideration ESM are particularly encouraged.

For FY 2003, the ALS Project will emphasize:

Pilot Studies

Microgravity Waste Processing

Novel physicochemical and biological research and technology development pilot study proposals that will help develop waste processing methods for safe storage of wastes are of interest. It is envisioned that the results of these studies would be incorporated into the integrated ground tests or could be implemented on the ISS. In terms of resource recovery, the main focus should be recovery of water from solid wastes. In developing these pilot studies, microgravity compatibility must be taken into consideration.

Conventional Studies

Waste Processing

Waste processing methods are needed that deal with solid wastes that include human metabolic wastes, paper products, uneaten food, small amounts of inedible plant biomass, and other waste solids likely to be generated in a space-based vehicle and early planetary surface habitats. Examples of solid waste processing technologies include transport of solid wastes, de-watering, sterilization, and safe storage methods. Research proposals covering all facets of solid waste processing, including thermal management of waste processing systems, on space-based vehicles or early planetary surface habitats are solicited.

Food Processing

Food processing methods and technologies for pre-packaged and stored staple foods expected to constitute a major portion of crew diet on later ISS, on space transportation vehicles, and early planetary exploration missions are solicited. Food processing methods for salad machine crops and bulk stored food ingredients are also solicited.

Proposals that emphasize any of the other ALS areas may be given a lower funding priority irrespective of the peer review proposal score.

ALS Flight Experiments (see also Flight Experiments, Section IV of this Appendix)

Knowledge of the effects of microgravity on life support systems is essential for their ultimate implementation in relevant environments. A major technology goal of the ALS Project is to resolve issues of performance in microgravity through research and evaluation in space. Therefore, the ALS Project solicits proposals to examine the gravitational sensitivity of candidate life support processes, components, and subsystems.

NASA Technical Contacts

Due to the applied nature of the ALS Project, proposals solicited by this Announcement primarily tend to be for technology development and applied, rather than fundamental, research. Research undertaken and technologies developed for ALS tend to find ready application and rapid integration into NASA's ongoing programs.

In order for applicants to better understand NASA's scientific and technological needs and to enable more effective transfer of their scientific and technological advances to NASA, it would be advantageous for applicants to explore opportunities to interact with the NASA ALS personnel listed below:

Charles J. Barnes, Ph.D.
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300 E Street, SW
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Donald L. Henninger, Ph.D.
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Investigators should refer to the Advanced Life Support Web site for additional information:

<http://advlifesupport.jsc.nasa.gov/>

Supporting Documents

Further information about the ALS Project can be found in the following documents (see Bibliography, Section VIII of this Appendix for details).

- Advanced Life Support Project Plan (1999)
- Advanced Life Support Program Requirements (1998)
- Advanced Life Support Technology Assessment Matrix (1998)
- ALS Roadmap (1998)
- ALS Metric (2001)
- Baseline Values and Assumptions Document (BVAD, 1999)
- Advanced Life Support Systems Integration, Modeling and Analysis Reference Missions Document, JSC 39502 Rev.A (2001)
- Advanced Technology for Human Support in Space: NRC Report (1997)

These supporting documents can be accessed via the Internet at the following address:

http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

C. Advanced Extravehicular Activity (AEVA)

Project Description

The AEVA Project of the AHST Program develops basic concepts and technologies, which enable humans to conduct complex work outside the pressurized volume of a spacecraft. As the current space shuttle and ISS EVA systems are not suitable for future planetary and deep space exploration applications, the AEVA Project for FY 2003 solicits research and development of life support systems and environmental radiation protection. These efforts will enable future EVA crewmembers to accomplish mission objectives safely, reliably, comfortably, and efficiently in a diversity of exploration environments and applications. An open architecture for remote locations is envisioned which can be readily adapted via flexible and modular systems utilizing common solutions and standardized interfaces. Teaming between the PIs and NASA engineers is encouraged to help focus and promote technology that can be practically integrated and tested with existing advanced hardware designs.

Proposals are sought for FY 2003 that are applicable to either Concept or Pilot studies **(listed in order of priority)**.

Atmosphere Revitalization

Methods are needed to reliably “scrub” CO₂, humidity, and trace contaminants from the portable life support system (PLSS) during EVA. Regenerable solutions that do not require the use of disposable filters or other consumables are needed. Preferably this system should be of long life, low power, and low weight impact to the suit and vehicle design.

Regenerable closed-loop thermal control systems, which do not consume resources, are needed. Highly conductive alternatives to water circulation lines and low power heating/cooling devices are sought. Efficient and effective heating/cooling thermal control components with automatic and manual bias selectivity are also of interest.

Environmental Protection

Passive and/or active portable radiation shielding materials and protection concepts are sought to enable work beyond low earth orbit. This capability must be a significant improvement over current EVA designs and should not impose any noticeable degradation in the suited crew’s mobility or manual dexterity.

Innovative pressure garment component designs and test articles are sought and must be compatible with a wide range of gravity, thermal and contamination environments. Mobility, low weight, low bulk, maintainability, and compatibility with terrestrial or in-cabin uses are some of the features of interest.

Flight Experiments

Flight experiments for the AEVA Project are not being solicited at this time.

NASA Contacts

Charles J. Barnes, Ph.D.
Code UB/Bioastronautics Division
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001
Telephone: 202-358-2217
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2101 NASA Road One
Houston, TX 77058
Telephone: 202-358-1453
E-mail: rfullert@hq.nasa.gov

Supporting Documents

Further information about the Advanced Extravehicular Activity Project can be found in the following documents (see Bibliography, Section VIII of this Appendix for details).

- Advanced EVA Systems Roadmaps (JSC 2000)
- Advanced EVA Exploration Requirements (JSC 2000)
- Advanced Technology For Human Support In Space (NRC 1997),
http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

Unless otherwise noted, these supporting documents can be accessed via the Internet at the following address:

<http://www.jsc.nasa.gov/xa/advanced.html>

IV. Flight Experiments

Proposals for space flight experiments for the time period between **2005 and 2007** may be submitted. All flight experiments must address one or more of the research programs and emphases described in this Research Announcement.

Research opportunities will be available during the construction phase of the ISS. The research will be accomplished during utilization flights when the Space Shuttle visits the ISS and during the time period between the utilization flights when the permanent onboard crew will act as experiment operators and, if necessary, as subjects. The duration of microgravity exposure can, in theory, be indefinite with periodic disturbances every 30 days caused by U.S. and Russian transportation vehicle docking activities.

It is expected that crew availability for science operations, power, and logistics resupply (frequency and mass to and from ISS) will be severely constrained throughout 2003 to 2005. The primary opportunities to transport scientific equipment, supplies, and samples will be on the utilization flights of the Shuttle. However, modest capabilities for research-related deliveries and sample returns will be available on assembly flights that will occur every 40 to 90 days. Refrigerated stowage for transport of samples on the Shuttle will be very limited, and during certain time frames, refrigerated stowage may not be available on the Space Station. Power outages may also be experienced during the assembly of ISS. Experiments with few or simple in-flight activities have the greatest potential for selection during this time frame due to their simpler logistic requirements.

The experiment opportunities are highly constrained in a number of ways. Proposals requiring resources beyond the capabilities defined below should not be submitted in response to this Announcement.

Potential applicants should recognize that, given the limited flight opportunities that are available, the flight experiments area is likely to be one of the most competitive arenas within biological and physical space research. Above all, flight experiments must have a justification that requires microgravity. Furthermore, only flight experiment proposals representing mature

studies strongly anchored in previous or current ground-based or flight research or technical evaluation will be selected. Ground-based research may, and often must, represent one component of a flight experiment proposal. That research should be limited to activities that are essential for the final development of an experiment for flight, such as definition of flight protocols and ground control activities of the flight experiment. In this case, only one (flight) proposal need be submitted.

It is anticipated that flight experiments will make use of existing hardware for Space Shuttle missions or planned hardware for ISS, or will propose the development of new hardware. Proposals for new hardware development should be compatible with implementation in EXPRESS racks on ISS.

Flight experiments should be proposed as if the actual flight of the experiment will occur between **2005 and 2007**. Experiments that cannot be implemented within this time period should not be submitted. Proposals requesting only one flight to meet their proposed research goals have a higher probability of being accomplished, but multiple flight opportunities may be granted if justified.

Finally, potential applicants should be aware that selection for flight is a multi-step process.

1. Following the initial evaluation of flight proposals, a small group of investigators will receive a letter informing them that their experiment has been selected for definition.
2. During the definition phase, NASA will interact with the applicant to determine whether the proposed experiment can actually be carried out on a space mission and to refine the cost estimates for the space flight experiment.
3. At the end of the definition phase, NASA will select a smaller group of investigations to be developed for flight. Normally, full investigator research funding does not begin until the initiation of the development phase.

Note: All experiments selected for flight are subject to possible deselection in accordance with the Advanced Human Support Technology Flight Experiment Management Policy available on the WWW at:

http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

All experiments are also subject to re-review every three years to determine continued retention.

V. Proposal Evaluation and Awards Selection Process

The following information is specific to this NRA and supersedes the information contained in Appendix C, Instructions for Responding to NASA Research Announcements.

A. Responsiveness to the NRA

All proposals must respond to the general requirements of the Announcement. Upon receipt, proposals will be reviewed for responsiveness to the requirements of this Announcement. This includes

- Submission of complete proposals on or before the due date specified in this Announcement (see Appendix B and Section VII.G of this Appendix)
- Responsiveness to the general requirements of NASA and the AHST Program as described in this Announcement and to the specific Project areas of emphasis as described in Section III of this Appendix
- Submission of a complete proposal, including a project description that does not exceed 20 pages in length (see Instructions, Appendix B)
- For proposals that represent revisions to proposals previously submitted to NASA, submission of a proposal with clearly marked revisions and a preface containing an explanation of how the revised proposal has addressed criticisms from previous NASA review (see Instructions, Appendix B)
- Submission of appropriate Institutional Review Board (IRB) or Animal Care and Use Committee (ACUC) certification for all proposals using human or animal test subjects (see Instructions, Appendix B)
- Submission of a budget that is within the guidelines specified in this Announcement and is for a funding period not to exceed 18 months for Pilot Study proposals or three years in duration for all others (see Section VII.A of this Appendix)
- Submission of all other appropriate materials as required by this NASA Research Announcement

Note: At NASA's discretion, non-responsive proposals may be withdrawn from the review process and returned to the proposer without further review.

B. Overall Evaluation Process

The overall evaluation process for proposals submitted in response to this Announcement will include the following reviews.

- **Merit Review:** A review for intrinsic technical or scientific merit will be conducted for all proposals.

Only those proposals most highly rated in the merit review process will undergo the following additional reviews:

- **Feasibility of NASA Implementation Review**
- **Flight Feasibility Review** (Flight proposals only)
- **Review for Relevance and Cost**

The most important element in the evaluation process is the merit review, which carries the highest weight in final evaluation and selection. The other factors are approximately equal in weight to each other.

Follow-on Requirements for Pilot Studies

For the Pilot Study proposal category, the initial 18 months of Phase I funding is envisioned to be the first of two phases. Phase II funding is not guaranteed by Phase I funding; however, Phase I funding is a prerequisite. Phase I will include two meetings with NASA Project PIs and other NASA-funded external PIs. The first meeting will occur shortly after funding is initiated, for introduction to ideas, projects, and people. The second meeting will occur approximately two-thirds of the way through the funding period and will focus on the development of application teams with concepts for taking Pilot Studies into existing application needs. Follow-on proposals, for three years' funding, are expected to be generated by these teams.

Phase II will emphasize the integration of Phase I approaches into actual technology development, with a strong emphasis on team development. Teaming will be encouraged among PIs and between PIs and NASA researchers, NASA-funded SBIRs and NASA CSTCs. Team development for Phase II will be facilitated through the NASA HQ lead, the NASA AHST Project leads, and the NASA Technical Monitors for the Phase I projects. Teams developed for Phase II projects will be expected to propose at the completion of Phase I, no later than within three months of Phase I completion. Phase II proposals will be separately evaluated, but will use criteria described later in this section for the merit reviews, with a strong emphasis placed on probability of a demonstration capability in a relevant environment at the end of the three-year funding period.

C. Merit Review

*A **merit** evaluation will be conducted for all proposals that are accepted by NASA for review (see Responsiveness to the NRA, Section V.A of this Appendix).*

The merit evaluation of proposals will be conducted by a panel of technical and/or scientific experts. The number and diversity of experts required will be determined by the response to this NRA and by the variety of disciplines represented in the proposals relevant to the research emphases described in Section III of this Appendix. The merit review panel will assign **a score from 0-100** or will designate the proposal as “not recommended for further consideration” based upon the intrinsic scientific or technical merit of the proposal. This score will reflect the consensus of the panel.

The score assigned by this panel will neither be affected by the cost of the proposed work nor will it reflect the programmatic relevance (meaning the relative priority of the proposed work to NASA). However, the panel will be asked to include in their critique of each proposal any comments they may have concerning the proposal's budget and relevance to NASA.

Reviewers will be asked to consider the following five criteria for each proposal. Panelists are instructed to address and consider each of these five criteria in assigning the overall score; however, review panels are given considerable latitude in integrating the evaluation of these criteria into a final score.

Review Criteria

- **Innovation:** Does the project employ novel concepts, approaches, or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?
- **Significance:** Does this study address an important problem within the context of the AHST Program as described in this NRA? If the aims of the application are achieved, how will knowledge or technology be advanced? What will be the effect of these studies on the concepts, methods, or products that drive this field?
- **Approach:** Are the conceptual framework, design, methods, and analyses adequately developed, well integrated, and appropriate to the aims of the project? Is the proposed approach likely to yield the desired results? Does the applicant acknowledge potential problem areas and consider alternative tactics? Is the proposal high-risk and high-payoff? Is it likely that the proposed implementation timeline will be met?
- **Investigator:** Is the investigator appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience level of the principal investigator and any co-investigators? Is the evidence of the investigator's productivity satisfactory?
- **Environment:** Does the scientific environment in which the work will be performed contribute to the probability of success? Do the proposed experiments take advantage of unique features of the scientific environment or employ useful collaborative arrangements? Is there evidence of institutional support?

D. Feasibility of Implementation Review

*This review will be conducted only for the most highly rated proposals from the **merit** review.*

The Feasibility of Implementation Review will be conducted, appropriate to the TRL level of the research proposed, by an engineering and technical review team assembled by NASA. For Pilot Studies, Feasibility of Implementation will look for potential critical problems, evident in the idea itself, which could render the research unfeasible for use by NASA. For longer-term or more mature proposals, evaluation for the feasibility of implementation of the results of the proposed work (i.e., the resulting technology or research results) into an operational NASA system will be conducted. This review team will evaluate the feasibility of implementing the resulting technology or research results utilizing available NASA flight and/or ground facilities. The purpose of the feasibility of implementation review is to assess the likelihood that the proposed research, if completed successfully, would lend itself to continued R&TD in the context of the AHST Program goals.

E. Flight Feasibility Review

*This review will be conducted only for the most highly rated flight experiment proposals from the **merit** review.*

The Flight Feasibility Review is an evaluation of the feasibility of implementation of the proposed work on a space platform. This review will be conducted by a team qualified to

determine the feasibility of implementing the proposed projects using available flight and ground facilities.

The following criteria will be used in performing the flight feasibility review:

- **Functional Requirement:** Will the available flight hardware meet the functional requirements of the experiment?
- **Space Platform Resource Requirements:** To what extent will this experiment consume the launch vehicle capacity and flight platform resources (such as crew time and electrical power) that are projected to be available? Are sufficient resources available? Does this experiment require such a large amount of the available resources that it will preclude conduct of other experiments? Based on the required number of samples or subjects, can the experiment be carried out within a reasonable period of time?
- **Operational Impacts:** For experiments that utilize the crew as research subjects, could the implementation of these experiments, even if considered safe, lead to an impact on the performance of the crew subjects?

F. Evaluation of Programmatic Relevance and Cost

*This review will be conducted only for the most highly rated proposals from the **merit** review.*

The evaluation of programmatic relevance and cost of each proposal will be conducted by NASA program scientists and managers as follows:

- **Programmatic Relevance:** In this context, programmatic relevance is the establishment of the relative priority of proposed projects for the AHST Program, based on current needs and considerations of programmatic balance. Programmatic relevance evaluation will include the Critical Path Research Plan. The Critical Path Research Plan is available at:

<http://criticalpath.jsc.nasa.gov/>
(follow links to appropriate discipline area).
- **Cost:** Evaluation of the proposed cost includes consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

G. Development of Evaluation Findings

Information resulting from these reviews will be used by NASA program scientists and managers to prepare evaluation findings developed for each of the AHST Program Projects described in this Announcement. This recommendation will be based on

1. the score for merit from the peer review panel (all proposals);
2. the results of the feasibility of implementation review (when conducted);
3. the results of the flight feasibility review (when conducted); and
4. the programmatic relevance and cost of each proposal (when conducted).

The findings of these evaluations will be presented by NASA program scientists and managers to the Director of the Bioastronautics Research Division, who will make the selection for funding.

VI. Support of Education and Public Outreach

Where appropriate, the supported institution will be required to produce, in collaboration with NASA, a plan for communicating to the public the value and importance of their work.

Once NRA selections are made, the selected PIs will have an opportunity to request additional funding through an OBPR-sponsored pilot program to implement an education outreach program at the grades 6-12 level, at an amount not to exceed \$5,000 per year for the term of the grant. A request for proposal will accompany the selection notification letter. Proposals will be due within 60 days of selection notification and shall be limited to 4 pages. A review of these proposals by educational specialists will determine which proposals will be funded.

VII. Program Management Information

A. Type of Awards to be Made

Funding increment:	One year at a time.
Funding duration:	18 months for Pilot Studies, one to three years for all others.
Number awarded:	Approximately 15-20 expected. Actual number awarded depends on number received, review panel(s) recommendation, and available funding.
Average funding:	Pilot Study proposals will average \$80,000 per proposal; longer studies will average \$175,000 per year.
Funding range:	Variable, with justification.

Role of NASA Field Centers

The NASA AHST Field Center with primary programmatic responsibility will have a primary role in oversight of these awards and will be responsible, with NASA's Bioastronautics Research Division, for annually evaluating their progress and out-year plans.

B. Eligibility

All categories of institutions are eligible to submit proposals in response to this NRA. Principal Investigators may collaborate with universities, Federal Government laboratories, the private sector, and state and local government laboratories. In all such arrangements, the applying entity is expected to be responsible for administering the project according to the management approach presented in the proposal.

The applying entity must have in place a documented base of ongoing high quality research in science and technology, or in those areas of science and engineering clearly relevant to the specific programmatic objectives and research emphases indicated in this Announcement. Present or prior support by NASA of research or training in any institution or for any investigator is not a prerequisite to submission of a proposal or a competing factor in the selection process.

All categories of institutions are eligible to submit proposals in response to this NRA, but only approved research proposals from U.S. institutions will be selected for funding.

C. Foreign Proposals

NASA will accept proposals from outside the U.S. and U.S. proposals that include non-U.S. participation. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan only for the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

All foreign proposals must be typewritten in English and comply with all other submission requirements stated in this NRA. These proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received on or before June 18, 2002. Foreign sponsors may, in exceptional situations, forward a proposal without endorsement if the endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with a foreign proposal or a U.S. proposal with a foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the foreign sponsor will each bear the cost of discharging their respective responsibilities.

Depending on the nature and extent of the proposed cooperation, these arrangements may entail

1. an exchange of letters between NASA and the foreign sponsor; or

2. a formal Agency-to-Agency Memorandum of Understanding (MOU).

Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation

Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation.. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at:

<http://www.pmdtc.org/>
and
<http://www.bxa.doc.gov/>

Investigators are advised that under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered “Defense Articles” on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

D. Program Reporting

The Principal Investigator is expected to maintain awareness of NASA’s needs in these areas, and to maintain communication with the appropriate points of contact at NASA, which are listed for each of the projects within the AHST Program in Section III of this Appendix.

It is expected that results from funded research will be submitted to peer-reviewed journals as the work progresses. Only published papers that acknowledge NASA’s support and identify the grant or contract will be counted as resulting from the research project and used to evaluate its productivity.

Annual Report

Investigators are required to provide NASA with annual report information. It will serve as the basis for determining the degree of progress of the project and continuation of the grant. The information provided in the Annual Report will be also be used for Task Book updates and will meet the requirements for both annual reports and the Task Book. Some of this information will also be made available to the scientific community and will be used to assess the strength of the Division’s programs. This report will be due 60 days prior to the anniversary date of the grant start date.

The Office of Biological and Physical Research publishes a comprehensive annual document titled OBPR Program Tasks and Bibliography (Task Book) which includes descriptions of all peer-reviewed activities funded by OBPR during the previous fiscal year. Since its inception, the Task Book has served as an invaluable source of information for OBPR as well as the scientific and technical communities.

The information requested will include

- An abstract
- A brief statement of progress during the fiscal year
- A brief statement of benefits of the research with respect to life on Earth
- A bibliographic list for the fiscal year
- A copy or reprint of each publication listed in the bibliography for the fiscal year
- A listing of presentations or activities conducted at 6-12 educational institutions
- A listing of interactions, presentations, or other activities with the general public
- Copies of publications
- A statement of progress
- Potential scientific, technological, economic or societal impact

Note that although this publication will be made available to the general scientific community, it is not a substitute for traditional scientific reporting in journals and elsewhere.

Final Report

A final report is required at the end of the funding period, which shall include all peer-reviewed publications. Information requested for inclusion in final reports is

- project summary;
- statement of the specific objectives;
- significance of the work;
- background;
- Overall Progress during the performance period;
- narrative discussion of technical approaches – including problems encountered;
- accomplishments related to approach; and
- an appendix with bibliography and copies of all publications and reports. Any publications or other public materials containing data are particularly important to include in this section.

Implementation Plan (not for Pilot Studies)

Investigators are requested to submit a proposed plan of implementation one year prior to the project end date. This plan will describe the process by which the results of the project could be implemented into a NASA program. Since construction of this plan will likely require one or more visits to NASA Field Centers, appropriate travel funds should be accounted for in the proposal (see Section VII.E of this Appendix). Please note that Pilot Study investigators are

expected to allocate funds for two trips to a NASA Field Center for discussions during the proposal term.

Flight Experiment Reports

Investigators selected to carry out Space Flight experiments are expected to provide NASA with two reports:

1. A “quick-look” report of preliminary flight results that is due one month after the Space Flight takes place.
2. A post-flight final report containing all data and information on the flight study is due approximately one year after all required data/materials are provided by NASA to the investigator. At this time, all of the data must also be provided to NASA for placement in the Life Sciences Data Archive; data in this archive will be made available to the scientific and technical community.

E. Other Considerations

Required Travel

The proposal must include travel funds for the following:

- Annual Principal Investigators meeting
- Collaborative visits with other Pilot Study Co-Investigators (Pilot Studies only)

Optional Travel

- Visits to NASA Field Centers (as many as necessary)
- Presentation at a professional society meeting (highly desirable)

Resident Research Associates

Intramural investigators who plan to request Resident Research Associate (RRA) postdoctoral fellows supported by the NASA-NRC Program should include this information in their list of personnel and budget.

F. Notice of Intent Submission Information

To facilitate proposal processing, potential Principal Investigators are requested to confirm plans to submit a proposal responding to this Announcement by sending a notice of intent (NOI) to propose. ***The NOI, which is not binding, should be submitted electronically by April 18, 2002, by 4:30 PM Eastern Time*** (See Summary and Supplemental Information, page 4 as well as Appendix B, “Instructions for Preparing a Notice of Intent”). If you do not have access to electronic submission, you may submit the NOI via U.S. Postal Service or by commercial delivery. The notice of intent, which should be no more than two pages, should contain:

- The name, affiliation, address, and telephone number of a single Principal Investigator and all Co-Investigators
- Identification of the research emphasis described in this Announcement that is most closely aligned with the proposal (Research emphases are listed as “Science Areas” in the SYS-EYFUS on-line system)
- A descriptive title of the proposal
- A brief yet thorough summary describing the proposed research (not to exceed 500 words)

G. Proposal Schedule

The following schedule is planned for the acquisition of investigations under this Announcement:

Notice of Intent to Propose Due	April 18, 2002
Proposal Due	June 18, 2002
Selection Announcement	November 2002
Solicitation of Education and Outreach Supplemental Proposals from Selected PIs	November 2002
Earliest Initial Funding Available	December 2002

VIII. Bibliography

NASA Top Level Strategic Plans and Reviews:

- **National Aeronautics and Space Administration Strategic Plan. (2000).** NASA, Washington, DC.
<http://www.hq.nasa.gov/office/codez/plans/pl2000.pdf>
- **NASA’s Enterprise for the Human Exploration and Development of Space: The Strategic Plan. (2001).** NASA, Washington, DC.
<http://www.hq.nasa.gov/osf/heds/hedsplan.html>
- **NASA’s Office of Biological and Physical Research.** NASA, Washington, DC.
<http://spaceresearch.nasa.gov/>
- **Advanced Technology for Human Support in Space. (1997).** Report of the National Research Council (NRC) Committee on Advanced Technology for Human Support in Space, Aeronautics and Space Engineering Board (ASEB), National Academy Press, Washington DC (ISBN 0-309-05744-2; 1997)
http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

- **Assessment of Programs in Space Biology and Medicine. (1991).** National Academy of Sciences, National Research Council. Committee on Space Biology and Medicine, National Academy Press, Washington, DC.

NASA AHST Discipline Science/Technology Plans and Requirements Documents produced by the projects within the Advanced Human Support Technologies Program in the Life Sciences Division, NASA, Washington, DC:

- **Advanced Human Support Technologies Program Plan (1999)**
- **Guidelines & Capabilities for Designing Human Missions (2002).** NASA Exploration Team Human Subsystem Working Group, National Aeronautics and Space Administration, Johnson Space Center, Houston, Texas.
- **Advanced Environmental Monitoring and Project Plan (1999)**
- **Advanced Environmental Monitoring and Control Technology Development Requirements (1998)**
- **Advanced Environmental Monitoring and Control Strategic Plan (1996)**
- **Advanced Environmental Monitoring and Control Program: Technical Assessment Matrix**
- **Advanced Life Support Project Plan (2002)**
- **Advanced Life Support Program Requirements (1998)**
- **Advanced Life Support Technology Assessment Matrix (1998)**
- **Advanced Life Support Metric (2001)**
- **Baseline Values and Assumptions Document (BVAD, 1999)**
- **Advanced Life Support Systems Integration, Modeling and Analysis Reference Missions Document (JSC 2001)**
- **Advanced Extravehicular Activity Exploration Requirements (JSC 2000)**
<http://www.jsc.nasa.gov/xa/advanced.html>

Unless otherwise noted, the above documents are available at
http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

NASA AHST Discipline Roadmaps produced by the projects within the Advanced Human Support Technologies Program in the Life Sciences Division, NASA, Washington, DC:

- **Advanced Environmental Monitoring and Control Roadmap (1999)**
- **Advanced Life Support Roadmap (1998)**
- **Advanced Extravehicular Activity Systems Roadmaps (2000)**
<http://www.jsc.nasa.gov/xa/advanced.html>

Unless otherwise noted, the above documents are available at
http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

NASA Cumulative Bibliographies: publications resulting from research supported by the Life Sciences Division:

- **Publications of the NASA Controlled Ecological Life Support System (CELSS) Program: 1989-1992. (1994)** J.V. Powers (Ed.). NASA Contractor Report 4603.
- **NASA Strategic Planning Documents:** publications resulting from activities supporting the development of strategic plans and research strategies:
- **A Strategy for Space Biology and Medical Science into the Next Century. (1998).** National Academy of Sciences, National Research Council, Committee on Space Biology and Medicine; Jay M. Goldberg, Committee Chairperson; National Academy Press, Washington, DC.
<http://books.nap.edu/books/0309060478/html/index.html>
- **Exploring the Living Universe: A Strategy for Space Life Sciences. (1988).** National Aeronautics and Space Administration Advisory Council. Life Sciences Strategic Planning Study Committee; Frederick C. Robbins, Committee Chairperson; National Aeronautics and Space Administration, Washington, DC.
- **Space Biology and Medicine: Volume II, Life Support and Habitability. (1994).** F.M. Sulzman and A.M. Genin (Eds.), American Institute of Aeronautics and Astronautics, Washington, DC.
- **Space Physiology and Medicine, 3rd ed. (1994).** A. Nicogossian, C. Huntoon, and S. Pool (Eds.) PA: Lea & Febiger, Philadelphia.
- **Strategic Considerations for Support of Humans in Space and Moon/Mars Exploration Missions. (1992).** National Aeronautics and Space Administration Advisory Council, Aerospace Medicine Advisory Council, National Aeronautics and Space Administration, Washington, DC.

Databases:

- **NASA OBPR Task Book.** An on-line database that includes descriptions of all peer-reviewed activities funded by OBPR during a given fiscal year.
<http://research.hq.nasa.gov/taskbook.cfm>
- **Spaceline.** An on-line bibliographic database; is available for searching for references to publications about space life sciences research.
Phone: 301-295-2482 E-mail: spaceline@usuhs.mil
<http://spaceline.usuhs.mil/>
- **Space Life Sciences Data Archive (LSDA).** An on-line database containing descriptions and results of completed NASA-sponsored flight experiments.
Phone: 281-483-7876 E-mail: lsda@semail.jsc.nasa.gov
<http://lsda.jsc.nasa.gov/>

Other Documents: Relevant research papers, review papers, conference reports and engineering documentation

- **Aftereffects and sense of presence in virtual environments: Formulation of a research and development agenda**, International Journal of Human-Computer Interaction; 10 (2) 134-187 1998, Lawrence Erlbaum Assoc Inc, Mahwah
- **Elements of Spacecraft Cabin Air Quality Control Design (1998)**, J.L. Perry, NASA TP-1998-207978
- **Expert Panel Review of Analytical Technologies Suitable for a Second-Generation Air Quality Instrument for the International Space Station (1998)**, sponsored by the NASA/JSC Toxicology Group, JSC 28254, Lyndon B. Johnson Space Center, Houston, Texas

Application Procedures

Except where specifically stated otherwise in this NRA, applicants must prepare proposals in accordance with the “Instructions For Responding to NASA Research Announcements,” which is part of the Federal Acquisition Regulations (FAR) Supplement (NFS), Part 1852.235-72.

These instructions are included as Appendix C of this document and can be found on the Web at:

<http://www.hq.nasa.gov/office/procurement/nraguidebook/gdbkapxb.html>

SYS-EYFUS Registration

SYS-EYFUS is an electronic system used by NASA Headquarters to manage research solicitation activity, plan for the receipt of research proposals, track the receipt and peer evaluation of these proposals, and manage funded research (grants, cooperative agreements, etc.) sponsored by NASA’s Office of Equal Opportunity (Code E), Office of Earth Science (Code Y), Office of Human Resources & Education Division (Code F), Office of Biological and Physical Research (Code U), Office of Space Science (Code S), and the Office of Space Flight (Code M). SYS-EYFUS also supports the funding and administration of awards pursuant to selection of these research opportunities.

The SYS-EYFUS Help Desk is available at (202) 479-9376. Help Desk hours are M-F from 8AM to 6PM Eastern Time.

All investigators planning to submit a proposal to this solicitation are requested to register online with SYS-EYFUS. Comprehensive help, instructions, and contact information are provided online. SYS-EYFUS can be accessed at the following address:

<http://proposals.hq.nasa.gov/>

If you have previously registered with SYS-EYFUS, you are asked to verify and update your user information. If you have forgotten your user ID or password, select the “Forgot Your Password” option and type in your first and last name to search our database. The system will send an automatic e-mail message with your username and password to the e-mail address listed in our database.

Instructions for Preparing a Notice of Intent

All investigators planning to submit a proposal in response to this solicitation are requested to submit a **non-binding** notice of intent (NOI) to propose by April 18, 2002, via the Web at the following address:

<http://proposals.hq.nasa.gov/proposal.cfm>

- 1) Login to SYS-EYFUS and select “New Notice of Intent.”
- 2) The Division Specific Opportunities screen will appear. In the selection window, highlight **Bioastronautics Research Division** and click on “Continue.”
- 3) The List of Existing Opportunities screen will appear. In the selection window, highlight **02-OBPR-01** and then click on “Continue.”
- 4) This will bring you to the Notice of Intent Submission Form. **All fields are required.**
- 5) Click on “Submit NOI Page.”
- 6) The Team Member Page screen will appear, where you can add or remove team members. Select continue if there are no other team members. To add a team member, highlight the role option on the selection list, type in first and last name and click on search. When the resulting set appears, choose the appropriate radio button and click on ADD to add the person to the NOI. After you are finished, click on “Continue.” **IMPORTANT:** If the team member is not listed in our database, please have them add themselves as a new user to the system. You may then add them to your team member list.
- 7) After continuing from the Team Members Page, your NOI will be displayed. Click on “Resubmit NOI Page” to complete your NOI submission.
- 8) You may edit and resubmit your NOI at any time before the submission deadline of April 18, 2002. Once you submit an NOI, it cannot be deleted. For title, team member, or any other changes, please edit your existing NOI and resubmit changes to avoid duplicate records.

The SYS-EYFUS Help Desk is available at (202) 479-9376. Help Desk hours are M-F from 8AM to 6PM Eastern Time.

Instructions for Preparing a Proposal

An original signed proposal plus twenty (20) complete copies of the proposal should be mailed to the address indicated and in the manner described in this document.

Applicants are encouraged to print their proposals double-sided (except forms), single-spaced, in a 12 point text font (except forms), and on 8.5" x 11" plain white paper. Also, proposals should be bound using only metal staples or metal binder clips.

All proposals submitted to the Advanced Human Support Technology Program must include the completed cover page form as described in this Appendix. The name of the Principal Investigator should appear in the upper right hand corner of each page of the proposal, except on the cover page form, where special places are provided for this information. Note that the proposal must specify the period of performance for the work described; periods of performance may be for any duration up to three years (18 months for Pilot Studies) but should be suitable for the project proposed.

The proposal must include the following material, in this order:

- (1) Proposal Cover Page: Solicited Proposal Application, including certification of compliance with U.S. code (if applicable).

One signed original required. Please see “How to Submit Proposal Cover Page Information” below for instructions on how to complete the proposal cover page information.

- (2) Transmittal Letter or Prefatory Material, if any (see Appendix C for details)
- (3) Proposal Title Page, with Notice of Restriction on Use and Disclosure of Proposal Information, if any (see Appendix C for details)
- (4) Statement of Justification

The one page justification should include a discussion on how the proposed research satisfies the unique requirements of the AHST program in general and the proposed research element in particular. In developing the justification, the Proposer(s) should refer to the relevant Program documents listed in Bibliography and identify how the proposed research would address issues such as systems integration, risk mitigation or reduction in the equivalent system mass.

- (5) Project Description

The length of the Project Description section of the proposal cannot exceed 20 pages using regular (12 point) type. Referenced figures must be included in the 20 pages of the Project Description. The Bibliography section is not considered part of the 20-page project description. Pages beyond the 20-page limit for the project description (22-page limit for revised proposals; see below) will not be reviewed. The proposal should contain sufficient detail to enable reviewers to make informed judgments about the overall merit of the proposed research and about the probability that the investigators will be able to accomplish their stated objectives with current resources and the resources requested. In addition, the proposal should clearly indicate the relationship between the proposed work and the research emphases defined in this Announcement. Reviewers are not required to consider information presented as appendices or to view and/or consider Web links in their evaluation of the proposal.

New applications where the investigator has received NASA funding in related fields from 1999 through 2001: Results and evidence of progress of the associated NASA supported research must be presented as part of the project description.

Revised applications (revisions of 1999, 2000 or 2001 submissions) must be so designated on the proposal cover page and explained in the project description. This explanation should be presented in a separate section of **no more than two pages at the beginning of the project description**, and is in addition to the 20 pages allowed for the project description. Related changes to the research plan should be highlighted in the body of the project description. Changes within the proposal may be highlighted by appropriate bracketing, indenting, or changing of typography. Clearly present any work done since the prior version was submitted. Revised applications that do not address the criticisms in the previous review will be considered non-responsive and will be returned without review.

(6) Management Approach

Each proposal must specify a single Principal Investigator who is responsible for carrying out the proposed project and coordinating the work of other personnel involved in the project. In proposals that designate several senior professionals as key participants in the research project, the management approach section should define the roles and responsibilities of each participant and note the proportion of each individual's time to be devoted to the proposed research activity. The proposal must clearly and unambiguously state whether these key personnel have reviewed the proposal and endorsed their participation.

(7) Personnel/Biographical Sketches

The biographical sketch for each investigator should not exceed two pages. If the list of qualifications and publications exceeds two pages, select the most pertinent information (see Appendix C for details). A sample Biographical Sketch form can be downloaded at

http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

(8) Other Support (see Appendix C for details)

A sample Other Support form can be downloaded at

http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

(9) Facilities and Equipment (see Appendix C for details)

(10) Special Matters (specific information on animal or human subjects protocol approval required, if applicable)

The Special Matters section must contain a statement from the investigator's institution that states that the proposed work will meet all Federal and local human subject requirements and animal care and use requirements, if applicable. Note that no animal subjects may be utilized unless specific information justifying and describing their use is included in the proposal. Policies regarding the protection of human research subjects in NASA-sponsored research are detailed in NASA Management Instruction (NMI) 7100.8B (Protection of Human Research Subjects), and animal care and use requirements are detailed in the NASA Code of Federal Regulations (CFR) 1232 (Care and Use of Animals in the Conduct of NASA Activities), both of which are available from the Office of Biological and Physical Research, Code UF, NASA Headquarters, Washington, DC, 20546. Assurance of compliance with human subject or animal care provisions is required, to be submitted with each proposal. In addition, a letter signed by the chairperson of the Institutional Review Board (IRB) or Institutional Animal Care and Use Committee (IACUC), or both, as appropriate, regarding approval of the experimental protocol should be included with each copy of the proposal. If IRB or IACUC review is unavoidably delayed beyond the submission of the application, a letter to that effect should be included. Be advised that the certification must be received within 60 days after the due date for which the application is submitted. **If certification is not received within 60 days after the application due date, the application will be considered incomplete and will not be reviewed.** NASA shall require current IRB or IACUC certification prior to each year's award. All U.S. non-NASA proposals providing IACUC approval must also contain the institution's Public Health Assurance number.

(11) Detailed Budget

To provide detailed budget information, you may download the sample forms located at

http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-01/index.html

NASA is expected to be operating on the basis of full cost accounting as soon as possible, including all Civil Service salaries with overhead. In the interim period, proposals should use the accounting method authorized at their institutions at the time proposals are due and for the entire proposed period of performance. Funds to support the Resident Research Assistant (RRA) Postdoctoral Program costs (e.g., stipend, travel, computer time, supplies, etc.) are to be budgeted within the NASA intramural Principal Investigator budget.

The budget must include travel funds for the Principal Investigator to attend a biannual BR&C Principal Investigator meeting. If other travel is planned, the proposal budget should include appropriate travel funds for visits to NASA field centers (as appropriate) and presentation of findings at professional society meetings.

(12) Supporting Budgetary Information

In this solicitation, the terms “cost” and “budget” are used synonymously. Sufficient proposal cost detail and supporting information are required; funding amounts proposed with no explanation (e.g., Equipment: \$1,000, or Labor: \$6,000) may cause delays in evaluation and award. Generally, costs will be evaluated for realism, reasonableness, allowability, and allocation. The budgetary forms define the desired detail, but each category should be explained in this section. Offerors should exercise prudent judgment in determining what to include in the proposal, as the amount of detail necessarily varies with the complexity of the proposal.

The following examples indicate the suggested method of preparing a cost breakdown:

Direct Labor

Labor costs should be segregated by titles or disciplines with estimated hours and rates for each. Estimates should include a basis of estimate, such as currently paid rates or outstanding offers to prospective employees. This format allows the Government to assess cost reasonableness by various means, including comparison to similar skills at other organizations.

Other Direct Costs

Please detail, explain, and substantiate other significant cost categories as described below:

- Subcontracts: Describe the work to be contracted, estimated amount, recipient (if known), and the reason for subcontracting.
- Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and the rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
- Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested as a direct charge must include the equipment description, how it will be used in the conduct of the basic research proposed, and why it cannot be purchased with indirect funds.
- Supplies: Provide general categories of needed supplies, the method of acquisition, and estimated cost.
- Travel: Describe the purpose of the proposed travel in relation to the grant, and provide the basis of estimate, including information on destination and number of travelers (if known).
- Other: Enter the total of direct costs not covered by a) through e). Attach an itemized list explaining the need for each item and the basis for the estimate.

Indirect Costs

Indirect costs should be explained to an extent that will allow the Government to understand the basis for the estimate. Examples of prior year historical rates, current variances from those rates, or an explanation of other basis of estimates should be included. Where costs are based on allocation percentages or dollar rates, an explanation of rate and application base relationships should be given. For example, the base to which the General and Administrative (G&A) rate is applied could be explained as: application base equals total costs before G&A less subcontracts.

All awards made as a result of this NRA maybe funded as grants or contracts. However, while proposals submitted by “for profit” organizations are allowed, they cannot include a “fee.”

- (13) Appendices, if any (**reviewers are not required to consider information presented in appendices**)

How to Submit Proposal Cover Page Information

All investigators planning to submit a proposal in response to this solicitation must electronically submit proposal cover page information online and provide a hardcopy of the cover page attached to each proposal copy by June 18, 2002. The proposal cover page can be submitted and printed via the Web at the following address:

<http://proposals.hq.nasa.gov/proposal.cfm>

- 1) Login to SYS-EYFUS.
- 2) To submit a New Proposal Cover Page, click the “New Proposal Cover Page” option on the SYS-EYFUS Options screen, and the New Proposals Cover Page screen will appear.
- 3) If you previously submitted an NOI in response to this solicitation, choose to carry over the existing NOI. This option will populate the cover page fields with the NOI information. Edit the information as necessary, click “Continue,” and proceed to #8 below.
- 4) If you did not previously submit an NOI, click on New Proposal Cover Page option, and the Division Specific Opportunities screen will appear.
- 5) In the selection window, highlight **Bioastronautics Research Division** and click on “Continue.”
- 6) The List of Existing Opportunities screen will appear. In the selection window, highlight **02-OBPR-01** and then click on “Continue.”
- 7) This will bring you to the Proposal Cover Page Submission Form. Fill in all the fields. All fields are required.

- a. For the proposal type field on this form, please choose one of the following options:
- Ground-New/No Prior Support
 - Ground-New/Prior Support
 - Ground-Revised
 - Pilot Study-New
 - Pilot Study-Revised
 - Flight-New/No Prior Support
 - Flight-New/Prior Support
 - Flight-Revised

Please do not select other options that may appear in the proposal type field.

On this form, ground, pilot study, and flight refer to the proposal types described in Appendix A Sections II.1, II.2, and II.3, respectively. On this form, new/no prior support (or new for pilot studies) means that the investigator **has not** received NASA funding from 1999 through 2001, new/prior support means that the investigator **has** received NASA funding between 1999 and 2001, and revised means that the proposal is a revised version of a proposal submitted to NASA and reviewed from 1999 through 2001, but not funded. A proposal previously submitted but not funded should be identified as being “revised” even if the original Principal Investigator has changed.

Click on “Continue.”

- 8) The Team Member Page screen will appear, where you can add or remove team members. Select “Continue” if there are no other team members. To add a team member, highlight the role option on the selection list, type in first and last name and click on “Search.” When the resulting set appears, choose the appropriate radio button and click on ADD to add the person to the proposal. After you are done, click on “Continue.” **IMPORTANT:** If the team member is not listed in our database, please have them add themselves as a new user to the system. You may then add them to your team member list.
- 9) After continuing from the Team Member Page, the Proposal Options Page appears.
- 10) Please fill out the budget form by clicking on the “Budget” button, filling in project costs, and clicking “Continue.” This will bring you to the Proposal Budget Review Page. Click “Continue” if the information is correct.
- 11) After verifying your budget information, you will be returned to the Proposal Options Page. Click the “Show/Print” button.
- 12) At the page entitled Proposal Information Item List, click “Continue” to preview your Proposal Cover Page. Print the cover page from your Internet browser once you have reviewed the information. The cover page must be signed by both the Principal

Investigator and the authorizing official and attached to the front of your proposal before submission of hard copies to NASA.

- 13) You may edit and resubmit your proposal cover page at any time before the submission deadline of June 18, 2002. Please note that once you submit a proposal cover page, it cannot be deleted. For title, team member, budget or any other changes, please edit your existing proposal cover page and resubmit changes to avoid duplicate records.
- 14) One (1) signed original and twenty (20) copies of the proposal must be received by 4:30 PM, June 18, 2002, at the following address:

NASA c/o NASA Peer Review Services
Subject: 02-OBPR-01 AHST Research Proposal
500 E Street SW
Suite 200
Washington, DC 20024

The SYS-EYFUS Help Desk is available at (202) 479-9376. Help Desk hours are M-F from 8AM to 6PM Eastern Time.

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

NASA FAR Supplement 1835.235-72 (**JANUARY 2000**)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the investigators' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

- (i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
- (ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (vi) Identification of the NRA, by number and title, to which the proposal is responding;
- (vii) Dollar amount requested, desired starting date, and duration of project;
- (viii) Date of submission; and
- (ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) Abstract. Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) Project Description.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) Management Approach. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) Personnel. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award.. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel

who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) Facilities and Equipment.

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) Proposed Costs (U.S. Proposals Only).

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by

U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) Security. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) Current Support. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) Special Matters.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Investigators should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) Renewal Proposals.

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) Length. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) Late Proposals. Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) Withdrawal. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) Evaluation Factors.

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) Evaluation Techniques. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) Selection for Award.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Investigators desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) NASA welcomes proposals from outside the U.S.. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without

endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(i) An exchange of letters between NASA and the foreign sponsor; or

(ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) Cancellation of NRA. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

**CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER
RESPONSIBILITY MATTERS**

PRIMARY COVERED TRANSACTIONS

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 14 CFR Part 1269.

A. The applicant certifies that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three-year period preceding this application been convicted or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification; and
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lowered Tier Covered Transactions (Subgrants or Subcontracts)

- a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.
- b) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

This page has been included for your information.

CERTIFICATION REGARDING LOBBYING

As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over \$100,000, the applicant certifies that:

- (a) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;
- (b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, an or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by S1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

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**CERTIFICATION OF COMPLIANCE WITH THE NASA REGULATIONS PURSUANT
TO
NONDISCRIMINATION IN FEDERALLY ASSISTED PROGRAMS**

The (Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant") hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S. 794), and the Age Discrimination Act of 1975 (42 U.S. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participating in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and the United States shall have the right to seek judicial enforcement of this assurance. His assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

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